

# UVCMetrics: Improved Diagnostics

Brian Smith<sup>1</sup>, Jeffrey Painter<sup>2</sup>, James McEnerney<sup>2</sup>



<sup>1</sup>Oak Ridge National Laboratory

Prepared by UT-Battelle LLC under Contract DE-AC05-00OR22725

<sup>2</sup>Lawrence Livermore National Laboratory

Prepared by LLNL under Contract DE-AC52-07NA27344.



## Summary

UVCMetrics is a new framework for climate scientists to analyze, verify, and compare multiple models (or observation sets). Data is reduced in time and other axes and plotted or summarized in tables. Notable features:

- Implements almost all diagnostics from NCAR's NCL-based land and atmosphere diagnostics
- Flexible – plot any variable in the data set(s) and compute new variables from the data; new seasons and regions can be defined
- Multiple ways for scientists to add new diagnostics
  - Tightly coupled: full integration in the framework
  - Loosely coupled: ability to run existing scripts in R, NCO, etc.
- Full command line support
- Individual diagnostics can be run from within UV-CDAT GUI
- Comparison of multiple models or models and observation
- Outputs PNGs, netCDF files, ASCII tables

## Approach

UVCMetrics is a series of Python scripts that make use of UV-CDAT for data analysis and visualization. The scripts are meant to be flexible and can be used in multiple ways.

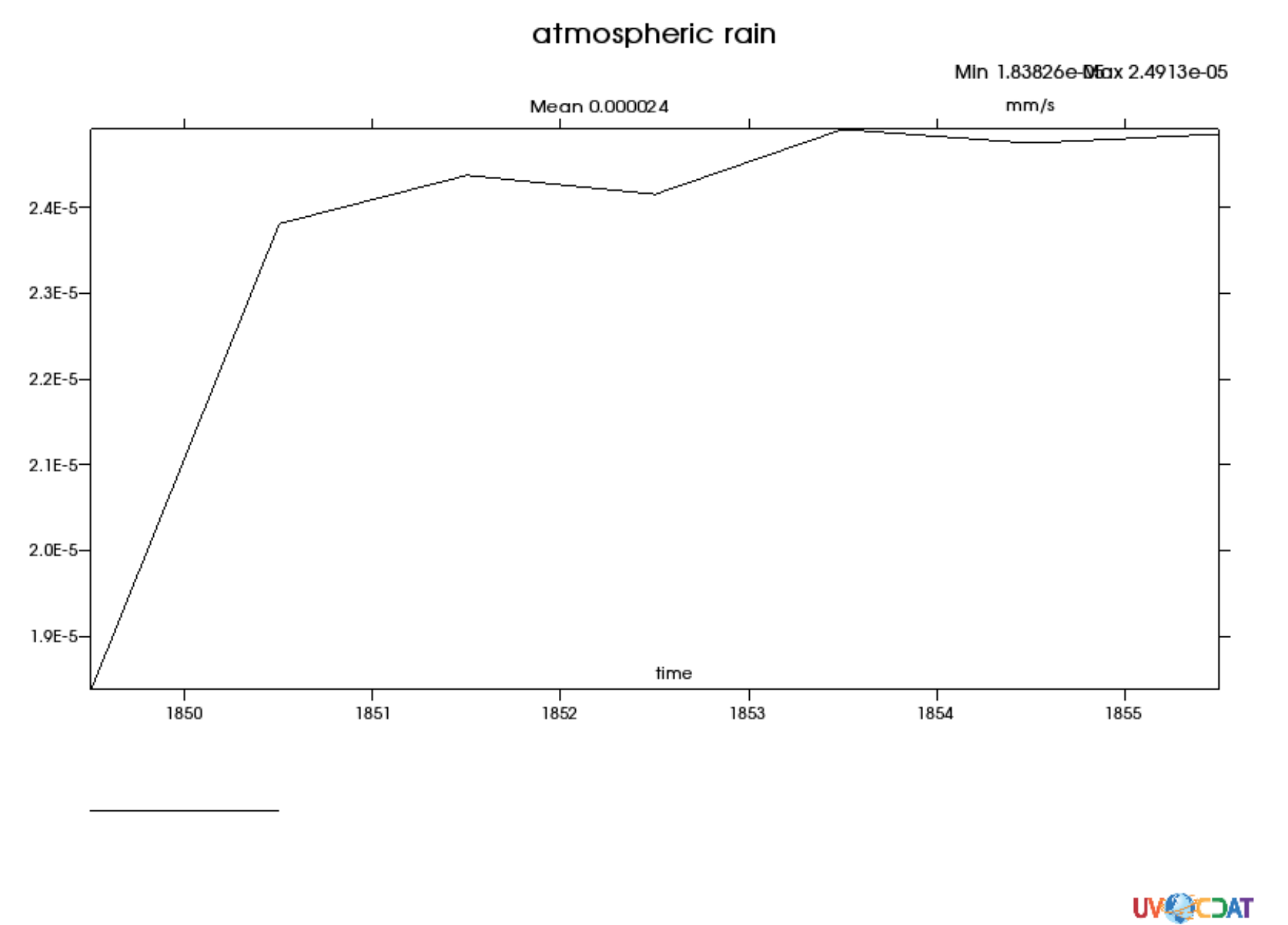
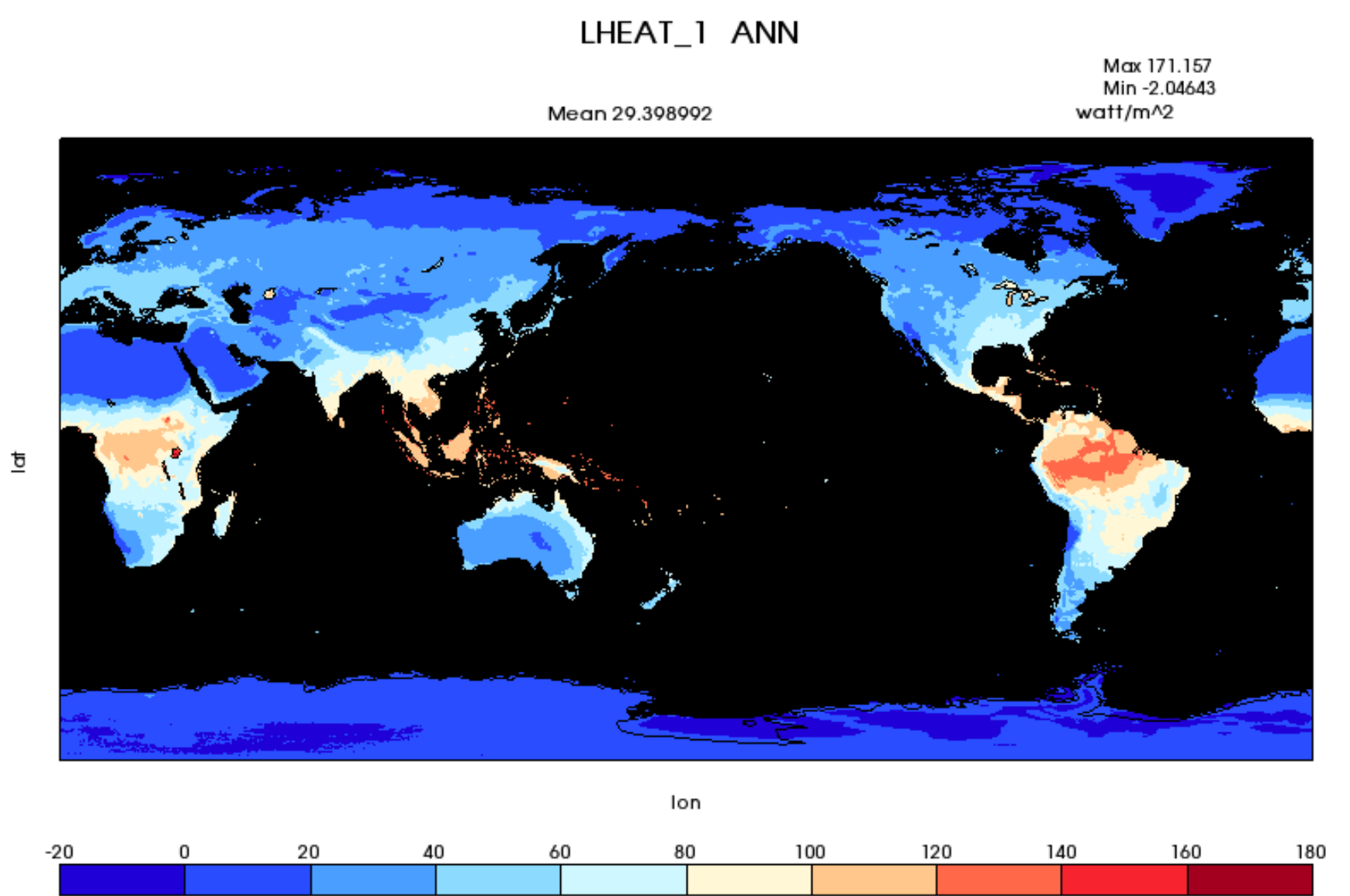
- `diags.py` – Create a diagnostics plot typically based on a single data set, single observation set, and one or more variables/regions/seasons.
- `metadiags.py` – Create many (thousands) of diagnostics plots based on the original NCL plot sets but with fewer restrictions on variables. Also create loosely coupled plot sets via R and NCO scripts and any additional tightly coupled plot sets plus Tier 1 diagnostics
- `climatology.py` – Generate summary climatology files (monthly, seasonal, annual)

## Impact

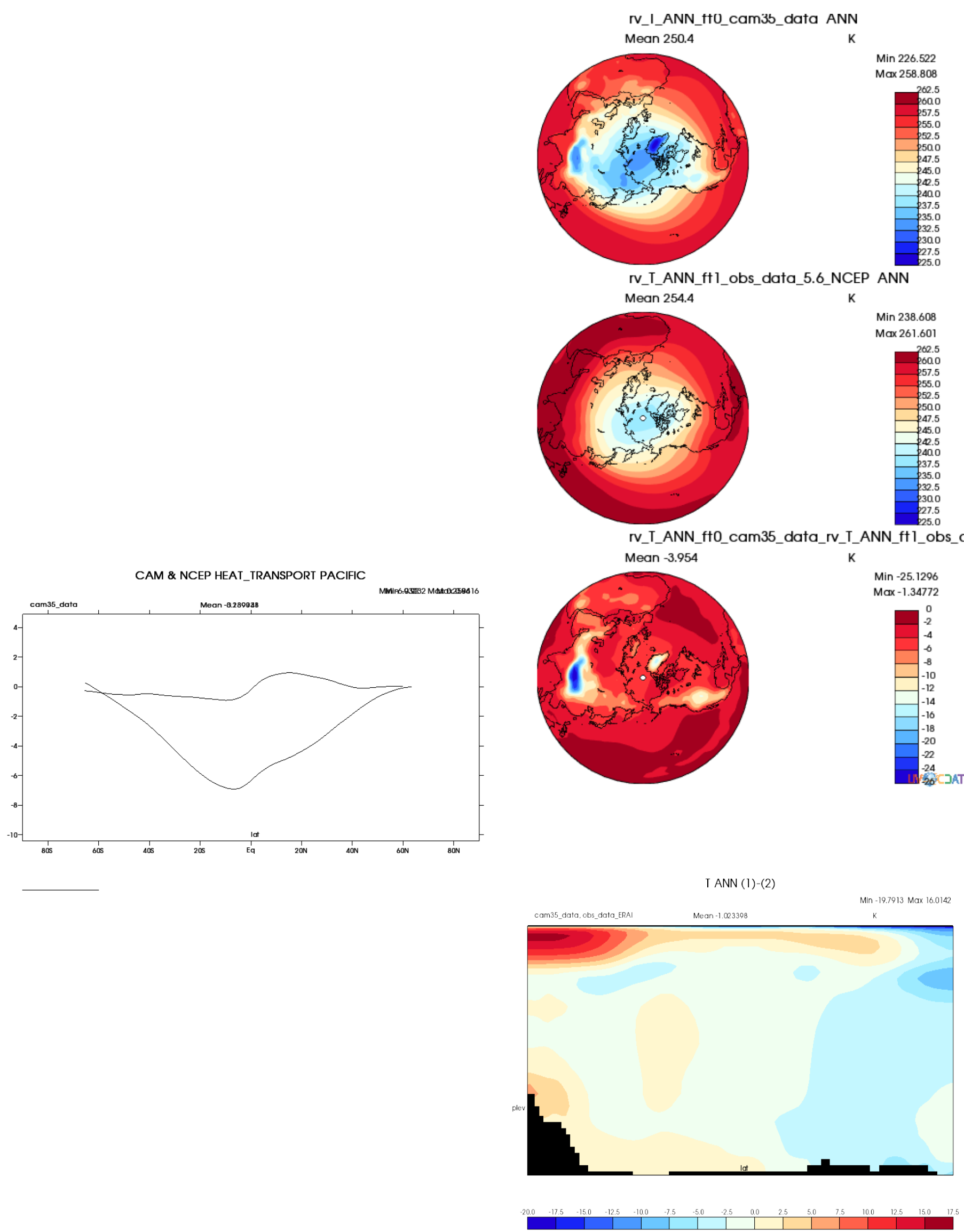
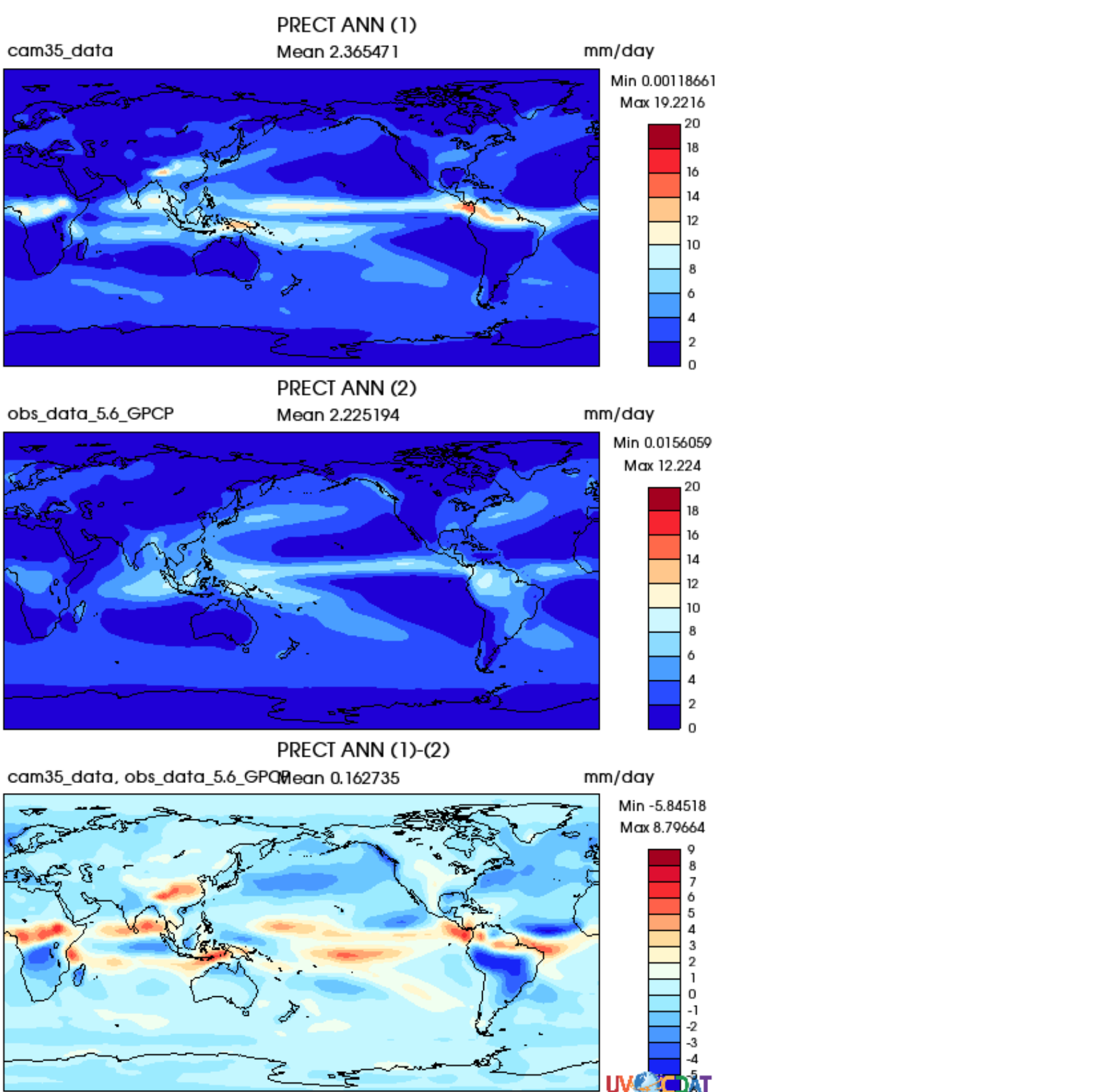
Most of the legacy NCAR plots are ported. Tier 1A sets and most Tier 1B atmosphere sets are also complete. We are gathering requirements for Tier 1 land sets now. In addition, scientists have ported new diagnostics to the framework, both tightly coupled and loosely coupled. Several thousand total plots (and tables) can be generated from atmosphere and land diagnostics runs.

Resultant data can be further analyzed in UV-CDAT or other standard tools. Visualization is provided via Classic Viewer or any PNG viewer.

## Example Land Plots



## Example Atmosphere Plots

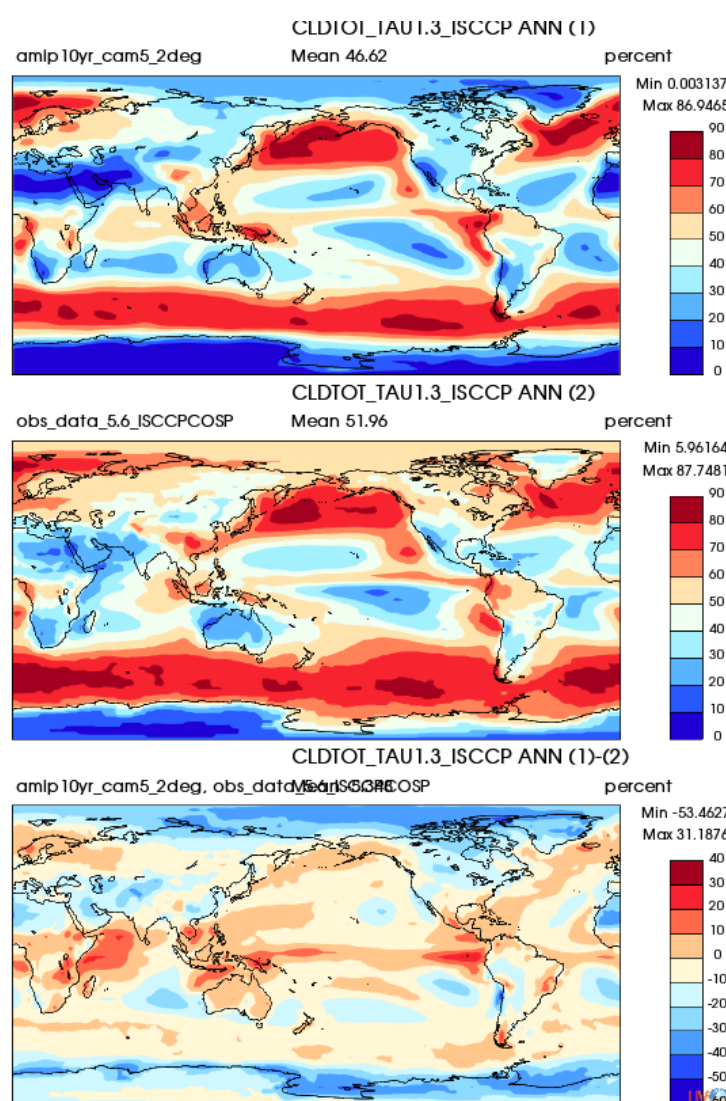


## Next Steps

- Improve performance, primarily by parallelization
  - Parallelization of individual plot sets to speed up computing
  - Parallelization of the general diagnostics framework to speed up the overall process.
- Add a generic plot method structured so that users may easily extend and customize it.
- We will have a cleaner system for managing names used in plot titles and labels.
- Define an API (with input from scientists) for the “loose coupling” mode
- Tie in to the ACME workflow process to increase automation
- Define and implement all Tier 1 land diagnostics

## Examples of Diagnostics Added by Users

Tier 1b Cloud Diagnostics, Tightly Coupled



Tier 1b Wind Diagnostics, Loosely Coupled

